

Appl. No. 10/538,768
Arndt, dated August 10, 2006
Reply to Office action of May 2, 2006
Art. Docket No. AP1012USN

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Amendments to the Claims:

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This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) Portable apparatus for measuring parameters of optical signals propagating concurrently in opposite directions in an optical transmission path (16, 16/1,..., 16/9) between two elements (10, 14/1...14/9), at least one (14/1...14/9) of the elements being operative to transmit a first optical signal (S1) only if it continues to receive a second optical signal (S2) from the other (10) of said elements, the instrument apparatus comprising first and second connector means (22, 24) for connecting the instrument apparatus into the optical transmission path in series therewith, and means (32, 38, 46) connected between the first and second connector means for propagating at least said second optical signal (S2) towards said at least one (14) of the elements, and measuring said parameters of said concurrently propagating optical signals (S1, S2).

2. (Previously presented) Apparatus according to claim 1, wherein the propagating and measuring means (32, 38, 46) provides an optical signal path between the first and second connector means (22, 24) for conveying at least a portion of said second optical signal (S2).

3. (Previously presented) Apparatus according to claim 2, wherein the propagating and measuring means (32, 38, 46) comprises:
coupler means (32) having first and second ports (28, 30) connected to the first and second connector means (22, 24), respectively, to provide said optical signal path to convey said first (S1) and second (S2) optical signals in opposite directions between said first and second connector means (22, 24), and a third port (34) for supplying a portion (S1') of said first optical signal (S1),
detection means (38; 38, 42; 38, 42, 44) for converting at least the first optical signal portion (S1') into a corresponding electrical signal, and
measuring means (46) for processing the electrical signal to provide an indication of said measured parameters.

4. (Previously presented) Apparatus according to claim 3, wherein the coupler means (32) has a fourth port (36) for supplying a portion (S2') of said second optical signal (S2), the detection means (38; 38, 42; 38, 42, 44) also converting at least part of the second optical signal portion (S2') into a corresponding second electrical signal, and the measuring means (46) processing both of the electrical signals to provide desired measurement values of parameters for each of the counter-propagating signals.

5. (Previously presented) Apparatus according to claim 1, wherein, where said one of the

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elements (14/1,..., 14/9) also receives via said optical transmission path a third optical signal (S3) at a different wavelength from that of said second optical signal (S2), the propagating and measuring means (46) further comprises means (40, 44, 52, 58; 44, 58, 68) for measuring parameters of the third optical signal (S3).

6. (Previously presented) Apparatus according to claim 4, wherein, where said one of the elements (14/1,..., 14/9) also normally receives via the optical transmission path a third optical signal (S3) at a different wavelength to that of said second optical signal (S2), the propagating and measuring means (46) further comprises a splitter (40) connected to the coupler means (32) for splitting a corresponding optical signal portion (S2', S3') into two parts (S2'', S3''), each comprising portions of both the second and third optical signals, and filter means (64, 66) coupled to the splitter (40) for separating the two parts according to wavelength before supplying same to said detection means (38, 42, 44).

7. (Previously presented) Apparatus according to claim 4, wherein, where said one of the elements (14/1,..., 14/9) also normally receives via the optical transmission path a third optical signal (S3) at a wavelength different from that of said second optical signal (S2), said propagating and measuring means comprises a wavelength discriminator (68) connected to the coupler (32) for separating at least a portion (S2', S3') of the combined second and third optical signals (S2, S3) according to wavelength to obtain corresponding separate portions (S2'', S3'') and supplying same to said detection means (38, 42, 44).

8. (Previously presented) Apparatus according to claim 1, wherein the measuring means comprises a separate detector (38, 42, 44) for each of the measured optical signal portions.

9. (Previously presented) Apparatus according to claim 1, wherein, where one of the optical signals is analog, the measuring means (46) is arranged to extract the time-averaged optical power of the signal.

10. (Previously presented) Apparatus according to claim 1, wherein, where one (S1) of the optical signals comprises bursts of digital data alternating with lulls, the measuring means (46) is arranged to extract the average of the optical power averaged over the duration of the individual bursts.

11. (Previously presented) Apparatus according claim 1, wherein the measuring means (46) comprises custom circuitry.

12. (Previously presented) Apparatus according to claim 1, wherein the measuring means (46)

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comprises a suitably-programmed microcomputer.

13. (Previously presented) Apparatus according to claim 1, wherein said measuring means further comprises display means (60) for displaying the parameter measurements.

14. (Currently amended) A method of measuring parameters of at least one of optical signals propagating concurrently in opposite directions in an optical transmission path (16, 16/1,..., 19/9) between two elements (10, 14/1...14/9), at least one (14/1...14/9) of the elements being operative to transmit a first optical signal (S1) only if it continues to receive a second optical signal (S2), the method comprising the steps of:

connecting first and second connector means (22, 24) of an instrument portable measuring apparatus into the optical transmission path in series therewith,

using the instrument apparatus to propagate at least said second optical signal (S2) towards said at least one (14) of the elements, and

measuring said parameters of said concurrently propagating optical signals.

15. (Currently amended) A method according to claim 14, wherein the instrument apparatus provides an optical signal path between the first and second connector means (22, 24) for at least said second optical signal (S2).

16. (Currently amended) A method according to claim 15, wherein the instrument apparatus has a coupler means (32) having first and second ports (28,30) connected to the first and second connector means (22, 24), respectively, to provide said optical signal path for conveying said first (S1) and second (S2) optical signals in opposite directions between said first and second connector means (22, 24), and a third port (34) for a portion (S1') of said first optical signal (S1) propagating in said optical signal path, the method comprising the steps of:

extracting said portion (S1') of said first optical signal (S1) from said third port of the coupler means,

converting the first optical signal portion (S1') into a corresponding first electrical signal, and processing the first electrical signal to provide an indication of said measured parameters.

17. (Previously presented) A method according to claim 16, further comprising the steps of extracting from a fourth port (36) of the coupler (32) a portion (S2') of said second optical signal (S2) propagating in the optical signal path;

converting the second optical signal portion (S2') into a corresponding second electrical signal; and

processing said first and second electrical signals to provide the desired parameters for each

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of the counter-propagating optical signals.

18. (Previously presented) A method according to claim 14, wherein, where said one of the elements (14/1,..., 14/9) also receives via the optical transmission path a third optical signal (S3) at a wavelength different from that of said second optical signal (S2), the measuring step also measures parameters of the third optical signal (S3).

19. (Previously presented) A method according to claim 17, wherein, where said one of the elements (14/1,..., 14/9) also receives via the optical transmission path a third optical signal (S3) co-propagating with the said second optical signal (S2) at a wavelength different from that of the said second optical signal (S2), the measuring step includes the steps of splitting a portion of the co-propagating optical signals into two parts, each comprising portions of the second and third optical signals (S2, S3), separating each of the two parts according to wavelength, converting said parts into said second electrical signal and a third electrical signal, respectively, and also processing the third electrical signal to obtain parameters of the third optical signal (S3).

20. (Previously presented) A method according to claim 17, wherein, where said one of the elements (14/1,..., 14/9) also receives via the optical transmission path a third optical signal (S3) co-propagating with the said second optical signal (S2) at a wavelength different from that of the said second optical signal (S2), said measuring step employs a wavelength discriminator (68) connected to the coupler (32) for splitting a portion of the co-propagating optical signals into two parts each corresponding to a respective one of the second and third optical signals, converting the parts to said second electrical signal and a third electrical signal, and also processing the third electrical signal to obtain parameters of said third optical signal (S3).

21. (Previously presented) A method according to claim 14, wherein the detection step uses a separate detector (38, 42, 44) for each of the measured optical signals.

22. (Previously presented) A method according to claim 14, wherein, where one of the optical signals is analog, the detection and processing derives the time-averaged optical power of the signal.

23. (Previously presented) A method according to claim 14, wherein, where one (S1) of the optical signals comprises bursts of digital data alternating with lulls, the detection and processing derives the average of the optical power averaged over the duration of the individual bursts.

24. (Previously presented) A method according to claim 14, wherein the processing is performed using custom circuitry.

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25. (Previously presented) A method according to claim 14, wherein the processing is performed using a suitably-programmed microcomputer.

26. (Previously presented) A method according to claim 14, further comprising the step of displaying the parameter measurements.

27. (Previously presented) A method according to claim 14, wherein the measurements are performed upon optical signals propagating concurrently in opposite directions in an optical transmission path between network elements in a passive optical network.